PROPOSED FINAL
BAY AREA
'94 CLEAN AIR PLAN
Volume IV
APPENDIX H
Source Inventory Description

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Prepared by
Bay Area Air Quality Management District
in cooperation with
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EMISSION INVENTORY--OVERVIEW

Background

An emission inventory is an itemized list of emission estimates for sources of air pollution in a given area, for a specified time period. Present and future year inventories are critical components of air quality planning and modeling. The ultimate goal of the planning process is to identify and achieve an emission pattern which does not result in violation of ambient standards.

The BAAQMD began preparing inventories since 1957. The current emission inventory to be used for planning is different from traditional inventory reports, which show annual average emissions by county. For ozone planning, a typical summer day inventory is needed.

The inventory is divided into stationary (point, area and biogenic) and mobile source emissions. Stationary source emissions are calculated by the BAAQMD using various procedures. Emission computation methodology by source categories is set forth in the BAAQMD publication "Source Category Methodologies." The BAAQMD participates in the California Emission Inventory Technical Advisory Committee (EITAC) and maintains the best available inventory methodologies.

Stationary Source Emissions

Point Sources. Sources identified on an individual facility or source basis are called point sources. Refineries and industrial plants are examples of point sources. The emission characteristics of individual facilities vary widely and each facility is examined individually. The Permit Services Division of the BAAQMD collects and maintains a computer data bank with detailed information on point sources. Almost all facilities emitting greater than 2.5 tons/year of any air pollutant are included. The 1990 base year inventory accounts for about 3,900 facilities, with 20,000 different sources. There are about 35,000 different processes, because some sources have more than one process (e.g., boilers burning different fuels, tanks storing different materials, and painting/ printing operations using different coatings).

Data on the activity, seasonal variations, and hours of operation are collected at the process level from each facility. Parameters which affect the quantity of emissions are updated regularly. Emissions are calculated using the detailed data for each of the 7,000 processes listed as storage of organic liquid, and 10,000 processes listed as organic solvent users. The emissions from

combustion and other general processes are computed using generalized or specific emission factors. These factors are periodically reviewed and updated.

Area Sources. Those stationary sources which are not identified individually are called area sources. This term is sometimes extended to cover numerous small point sources such as dry cleaners or gas stations which are known (at least potentially) individually. It always includes the diverse, unpermitted small sources which individually do not emit significant amounts of pollutants but which together make an appreciable contribution to the emission inventory. Examples of area sources are residential heating and use of paints, varnishes, and consumer products. Emissions from these sources are grouped into categories and calculated based on surrogate variables. Information on these surrogates is usually available for the State or by county. Selected surrogates are used to apportion the category emissions into diurnal and spatial patterns. Emissions for some source categories are estimated by the California Air Resources Board (ARB) based on statewide data.

Many area source categories are further classified into sub-categories for better emission computation, speciation, regulation development, and future year projections. For example, emissions from aircraft categories are subdivided into various aircraft types at each of the airports in the Bay Area. Architectural coating categories are subdivided into various types of coatings and varnishes to account for varying solvent content. There are more than 900 different sub-categories used in this inventory. Emissions for categories affected by regulations are adjusted to reflect the controls required and the estimated rule effectiveness achieved.

Biogenic Sources. In addition to man-made air pollution, there are significant quantities of pollutants from natural sources such as plants, animals, marshes, and the earth itself. Vegetation for example, emits large amounts of isoprene, terpenes, and other organic compounds which are precursors of ozone. Emission rates depend upon species, season, biomass density, time of day, local temperature, moisture and other factors. Total reactive organic emissions from Bay Area vegetation are about 300 tons per day and are not included in the Planning Inventory in this report. The emission estimates are developed using a personal computer version of the Biogenic Emissions Inventory System (PC-BEIS).

Mobile Source Emissions

Mobile sources consist of on-road motor vehicles and other sources, such as ships, aircraft, garden and construction equipment. Emissions from on-road motor vehicles are a major portion of the emissions inventory and are estimated using procedures developed by ARB.

ARB uses EMFAC and BURDEN computer models for the development of the on-road motor vehicle emissions inventory. EMFAC calculates emission rates for a variety of vehicle types (passenger cars, trucks, etc.), fuel usage, control technology and mode of operation. It also accounts for vehicle age, and operating conditions such as speed and temperature. Emission factors are produced for summer and winter operations to reflect the type of fuel in use, such as winter-time oxygenated fuel and summer-time fuel which has lower volatility (lower Reid Vapor

Pressure) than winter. Emission reductions resulting from California's Inspection and Maintenance ("Smog Check") program are incorporated. EMFAC7F was used for this inventory.

BURDEN uses emission factors from EMFAC and a large data base of activity for each county to calculate total daily emissions. The activity is in the form of number of in-use vehicles, number of cold and hot starts and vehicle miles traveled (VMT) for each vehicle type. The activity data for these calculations are developed using MTC's regional travel model and supplemental calculations. The planning version of BURDEN7F was used for this inventory, and is described under "Planning Inventory", below.

Various methodologies are used for compilation of the remaining mobile sources. Emission factors and methodologies for these sources are provided by ARB and EPA. Aircraft mix and activity data specific to each airport were used in estimating emissions at airports.

Planning Inventory

A planning inventory is a seasonal inventory representing emissions when a pollutant's concentrations are at their highest levels. For example, the emission inventory for the ozone season represents emissions occuring during the summer season when ozone levels are highest. The emission inventory for the carbon monoxide season represents emissions occuring during the winter season when carbon monoxide levels are highest. The seasonal inventories (summer and winter) are prepared based on the ARB's published guidelines described below.

The point source emissions are based on "average annual operating day" during the year. Therefore the summer and winter point source emissions are the same. Area source emissions are based on "average seasonal operating day". The summer season is considered May through October and the winter season is considered November through April. Data on normal operating schedules (hours per day, days per week and weeks per year) are collected as part of routine point source inventory procedures. For area sources, representative profiles showing monthly, weekly, and daily variation in emissions are prepared for each source category. These profiles are then used to obtain average seasonal operating day emissions.

For on-road motor vehicles, the planning version of BURDEN7F was used to develop planning inventories. The emission estimates for these inventories are based on ambient temperature profiles representing the ten days having the highest pollution levels. Summer temperature profiles are used to generate the ozone-precursor (ROG and NO_x) emission inventory, and winter temperature profiles are used for CO emissions.

BURDEN divides the day into six different time periods consistent with motor vehicle activity patterns, including the morning and evening commute periods. These six periods are: 12am - 6am, 6am - 9am, 9am - 12pm, 12pm - 3pm, 3pm - 6pm, and 6pm - 12am. For each period, specific temperatures, activity data and vehicle speeds are used to estimate emissions. The emissions from the six periods are then summed to get daily emissions.

The above calculations are carried out for each county. For Solano and Sonoma, only the portions under District jurisdiction are represented. As mentioned earlier, a distribution of vehicle miles traveled, vehicle trips and average vehicle speed for each county was derived from data supplied by MTC. The number of vehicles by vehicle class (e.g., light duty truck, motorcycle, etc.) was based on vehicle registration information supplied by ARB.

1990 EMISSION INVENTORY AND BASELINE PROJECTIONS

Baseline emission inventory projections for future years are essential for evaluating the impact of proposed control measures. Future baseline emissions are forecast from the base year (1990) emission inventory by utilizing projected growth rates and calculating the year-by-year effectiveness of already-adopted control measures. Historical emissions are based on previously compiled inventories with changes if more information is now available. Total baseline emissions for the years 1987, 1994, 1997, 2000, are shown in Table H-1 and the emissions by major source categories are shown in Table H-3. The emissions are presented in tons/day for Reactive Organic Compounds (ROG), Oxides of Nitrogen (NO_x), and Carbon Monoxide (CO). As mentioned earlier, the ROG and NO_x emissions are based on summer day and CO emissions are based on a winter day. Reactive organic emissions are derived from total organic emissions by excluding the nonreactive organic compounds listed in Table H-2.

TABLE H-1

TOTAL BASELINE EMISSIONS IN THE BAY AREA AIR BASIN

(Tons per planning day)

Pollutant	1987	1994	1997	2000
ROG	706	548	483	459
NO_x	621	545	510	486
CO	4101	2994	2691	2387

TABLE H-2

NONREACTIVE COMPOUNDS

1. Methane
2. Methylene chloride
3. Methyl Chloroform (1,1,1 Trichloroethane)
4. Trichlorotrifluoroethane (CFC-113)
5. Trichlorofluoromethane (CFC-111)
6. Dichlorodifluoromethane (CFC-12)
7. Chlorodifluoromethane (CFC-22)
8. Trifluoromethane (CFC-23)
9. Dichlorotetrafluoroethane (CFC-114)
10. Chloropentafluoroethane (CFC-115)

Table H-3

Bay Area Baseline Emission Inventory Projections : 1987 - 2000

Planning Inventory (Tons/Day)

	Reactive Organic Gases				Oxides of Nitrogen				Carbon Monoxide			
	1987	1994	1997	2000	1987	1994	1997	2000	1987	1994	1997	2000
IND/COMMER.PROCESSES												
PETROL. REFINING FACILITIES												
Basic Refining Processes	0.11	0.12	0.13	0.13	9.50	10.35	10.56	10.90	0.00	0.00	0.00	0.00
Wastewater (Oil-Water) Separators	4.25	3.70	3.77	3.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wastewater Treatment Facilities	0.98	1.07	1.09	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cooling Towers	0.97	1.06	1.08	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flares and Blowdown Systems	0.07	0.08	0.08	0.08	1.10	1.20	1.23	1.26	0.53	0.57	0.59	0.60
Other Refining Processes	0.61	0.67	0.68	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fugitives	13.34	9.89	8.58	8.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub total	**20.34**	**16.58**	**15.42**	**15.64**	**10.61**	**11.55**	**11.79**	**12.16**	**0.53**	**0.57**	**0.59**	**0.60**
CHEM. MANUFAC. FACILITIES												
Sulfur	0.02	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04
Coatings & Inks	1.76	1.69	1.72	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Resins	0.11	0.14	0.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pharmaceuticals & Cosmetics	0.46	0.50	0.51	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Chemicals Mfg.	1.40	1.33	1.35	1.42	2.45	2.32	2.36	2.48	27.53	26.07	26.55	27.84
Fugitives - Valves & Flanges	0.18	0.18	0.19	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub total	**3.93**	**3.85**	**3.95**	**4.07**	**2.50**	**2.36**	**2.41**	**2.52**	**27.57**	**26.11**	**26.59**	**27.88**
OTHER IND./COMMER. PROCESS												
Bakeries	1.85	1.57	1.62	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cooking	1.20	1.47	1.61	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wineries	0.55	0.57	0.58	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Food & Agricultural Process.	0.10	0.12	0.12	0.12	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00
Metallurgical	0.10	0.11	0.11	0.11	0.03	0.04	0.04	0.04	0.01	0.01	0.01	0.01
Contaminated Soil Aeration	0.49	4.04	4.04	3.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soil Vap. Extrac. & Air Stripping	0.37	0.11	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Concrete Plants	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03
Glass & Related Products Mfg.	0.17	0.22	0.25	0.26	0.03	0.04	0.04	0.04	0.01	0.01	0.01	0.01
Semiconductor Manufacturing	1.35	1.01	1.03	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flexible & Rigid Discs Manufac.	0.28	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fiberglass Products Manufac.	1.02	0.19	0.19	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table H-3 (Cont.)

	Reactive Organic Gases				Oxides of Nitrogen				Carbon Monoxide			
	1987	1994	1997	2000	1987	1994	1997	2000	1987	1994	1997	2000
Rubber Products Manufac.	0 23	0.31	0.34	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plastic Products Manufac.	0 30	0.28	0.28	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oil Production Fields	0 35	0 07	0.06	0.06	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Gas Production Fields	0 42	0.15	0.15	0.16	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Waste Management	9 20	5.08	5.13	5.16	0.15	0.16	0.17	0.17	0.01	0.01	0.01	0.02
Other Industrial Commercial	0.71	0.68	0.69	0.72	0.16	0.15	0.16	0.16	0.00	0.00	0.00	0.00
Sub total	**18.70**	**16.03**	**16.39**	**15.76**	**0.44**	**0.47**	**0.48**	**0.50**	**0.05**	**0.06**	**0.06**	**0.07**
PETROL./PRODUCT/SOLV.EVAP.												
PETROL. REFINERY EVAP.												
Storage Tanks	5.42	4.25	4.34	4.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loading Operations	4.33	1.72	1.76	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub total	**9.75**	**5.97**	**6.10**	**6.29**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
FUELS DISTRIBUTION												
Natural Gas Distribution	2.10	2.39	2.51	2.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulk Plants (Gasoline Only)	2.01	1.99	1.89	1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trucking	0.17	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gasoline Filling Stations	14.33	14.23	14.36	14.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aircraft Fueling	2.30	2.49	2.56	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recreational Boat Fueling	1.07	1.09	1.14	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ships & Tugboats Fueling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferry & Fishing Boats Fueling	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Fueling	0.58	0.64	0.66	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub total	**22.57**	**23.03**	**23.32**	**23.72**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
OTHER ORG. COMPOUNDS EVAP.												
Storage Tanks	1.70	1.58	1.65	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulk Plants & Terminals (Non-Gas.)	0.30	0.31	0.31	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lightering	1.51	0.08	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ballasting	0.86	0.94	0.96	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine Vessel Clean. & Gas Freeing	0.32	0.35	0.36	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sterilizers	0.47	0.19	0.20	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine Loading (Non-Refinery)	0.94	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Paving	2.54	0.62	0.66	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Petroleum Seeps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table H-3 (Cont.)

	Reactive Organic Gases				Oxides of Nitrogen				Carbon Monoxide			
	1987	1994	1997	2000	1987	1994	1997	2000	1987	1994	1997	2000
Industrial Degreasing	6.95	5.96	6.03	6.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial Degreasing	2.57	2.30	2.32	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Cleaners	5.15	5.27	5.46	5.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Printing	7.51	7.29	7.43	7.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adhesives & Sealants	20.28	23.17	14.19	13.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Structures Coating	32.60	27.33	26.09	24.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial/Commercial Coating	43.30	37.19	36.23	36.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Organics Evaporation	1.46	1.62	1.68	1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub total	**128.47**	**114.24**	**103.71**	**102.59**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
COMBUST.-STATIONARY SOURCES												
FUELS COMBUSTION												
Domestic	3.18	3.48	3.59	3.69	12.58	13.31	12.91	12.42	320.32	350.65	361.64	372.15
Cogeneration	1.03	1.19	1.25	1.31	11.30	13.13	11.52	8.41	3.96	4.64	4.78	4.82
Power Plants	0.42	0.18	0.19	0.22	36.76	21.46	20.79	24.16	7.43	4.72	4.79	5.57
Oil Refineries External Combustion	0.52	0.48	0.49	0.49	34.43	32.10	25.02	14.21	6.41	6.22	6.07	5.83
Glass Melting Furnaces - N.Gas	0.01	0.01	0.01	0.01	4.52	4.28	4.01	3.81	0.09	0.09	0.09	0.09
Reciprocating Engines	0.53	0.59	0.62	0.65	8.55	9.63	7.98	5.02	5.40	6.06	6.16	6.14
Turbines	0.13	0.14	0.14	0.14	2.19	2.24	2.26	2.28	1.09	1.12	1.14	1.15
Other External Combustion	0.75	0.81	0.86	0.91	28.31	29.25	23.95	16.74	14.69	16.20	16.91	17.66
Sub total	**6.57**	**6.89**	**7.15**	**7.43**	**138.64**	**125.39**	**108.44**	**87.04**	**359.39**	**389.70**	**401.58**	**413.41**
BURNING OF WASTE MATERIAL												
Resource Recovery Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Incineration	0.69	0.75	0.77	0.80	1.89	2.06	2.13	2.19	1.92	2.10	2.16	2.23
Planned Fires	0.04	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.73	0.86	0.90	0.93
Sub total	**0.73**	**0.80**	**0.82**	**0.85**	**1.89**	**2.06**	**2.13**	**2.19**	**2.65**	**2.96**	**3.06**	**3.16**
COMBUSTION-MOBILE SOURCES												
OFF-HIGHWAY MOBILE SOURCES												
Lawn	12.07	13.82	11.01	8.14	11.02	12.62	10.05	7.43	0.03	0.04	0.04	0.04
Transportation Refrigeration Units	0.24	0.21	0.21	0.21	1.95	1.88	1.92	1.95	0.86	1.18	1.22	1.00
Farm Equipment	1.08	1.23	1.24	1.29	6.69	7.42	7.84	8.10	4.39	5.17	5.40	5.64
Heavy Duty Ind./Construction Equip.	2.10	2.04	2.09	2.10	25.40	25.88	27.47	28.19	6.67	8.62	9.25	8.60
Light Duty Ind./Construction Equip.	24.28	26.50	27.17	27.90	101.36	106.87	113.65	116.95	230.06	269.13	288.44	294.71

Table H-3 (Cont.)

	Reactive Organic Gases				Oxides of Nitrogen				Carbon Monoxide			
	1987	1994	1997	2000	1987	1994	1997	2000	1987	1994	1997	2000
Locomotive Operations	0.51	0.48	0.47	0.46	12.38	11.76	11.49	11.23	1.64	1.56	1.52	1.49
Off Road Motorcycles	3.22	2.31	1.90	1.59	0.23	0.17	0.14	0.12	9.44	6.77	5.77	4.83
All Terrain Vehicles	0.86	0.62	0.53	0.44	0.03	0.02	0.02	0.01	4.52	3.24	2.76	2.31
Four-wheel Drive Vehicles	0.15	0.14	0.13	0.13	0.09	0.08	0.08	0.08	1.85	1.73	1.67	1.62
Ships Maneuvering	0.23	0.26	0.28	0.29	0.71	0.80	0.85	0.88	0.13	0.15	0.16	0.16
Ships Berthing	0.42	0.49	0.52	0.54	2.35	2.70	2.87	2.97	0.44	0.51	0.54	0.56
Ships In-Transit	0.67	0.76	0.81	0.84	2.34	2.67	2.83	2.92	0.40	0.45	0.48	0.50
Commercial Boats	0.44	0.48	0.49	0.52	1.73	2.03	2.18	2.30	1.33	1.38	1.45	1.50
Recreational Boats	16.94	19.43	20.03	20.96	5.71	7.75	8.47	9.18	77.38	94.51	100.78	107.04
Sub total	**62.15**	**67.56**	**65.92**	**64.69**	**161.48**	**170.63**	**180.43**	**186.05**	**386.10**	**448.78**	**469.51**	**473.42**
AIRCRAFT												
Commercial Aircraft	6.01	6.98	7.45	7.72	10.23	11.88	12.69	13.13	14.68	17.05	18.20	18.84
General Aviation	1.72	2.05	2.20	2.28	0.43	0.52	0.56	0.58	21.36	25.36	27.25	28.32
Military Aircraft	9.86	9.86	9.86	9.86	4.17	4.17	4.17	4.17	14.51	14.51	14.51	14.51
Agricultural Aircraft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.08	0.08	0.08
Sub total	**17.60**	**18.89**	**19.52**	**19.87**	**14.84**	**16.57**	**17.42**	**17.88**	**50.61**	**57.00**	**60.04**	**61.75**
ON ROAD MOTOR VEHICLES												
Light Duty Passenger	253.59	156.72	116.30	96.84	154.48	101.60	80.69	71.41	2372.41	1545.65	1304.85	1029.84
Light And Medium Duty Trucks	67.54	37.59	26.96	23.03	46.01	32.48	27.57	27.77	610.05	361.52	296.18	259.86
Heavy Duty Trucks	31.10	18.67	15.54	15.02	82.60	68.77	65.12	64.70	270.38	138.47	105.51	92.61
Heavy Duty Buses	1.11	0.92	0.92	0.96	6.60	4.58	4.29	4.34	4.11	4.39	4.47	4.54
Motorcycles-Non Catalytic	5.20	2.62	2.31	2.33	0.61	0.63	0.64	0.65	14.21	11.54	11.28	11.68
Sub total	**358.54**	**216.52**	**162.03**	**138.18**	**290.30**	**208.06**	**178.31**	**168.87**	**3271.16**	**2061.57**	**1722.29**	**1398.53**
MISCELLANEOUS OTHER SOURCES												
ACCIDENTAL FIRES												
Accidental Fires	0.19	0.21	0.22	0.22	0.10	0.10	0.11	0.11	3.56	3.88	3.99	4.11
Sub total	**0.19**	**0.21**	**0.22**	**0.22**	**0.10**	**0.10**	**0.11**	**0.11**	**3.56**	**3.88**	**3.99**	**4.11**
OTHER MISCELLANEOUS												
Sanitary Sewers	0.10	0.11	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Creosote Application	0.37	0.37	0.38	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Pesticides	3.15	3.15	3.15	3.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-Agricultural Pesticides	4.22	4.45	4.53	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products (no pesticides)	48.40	44.41	45.86	46.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub total	**56.25**	**52.49**	**54.04**	**54.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
BANKING EMISSIONS	0.00	5.13	5.13	5.13	0.00	8.38	8.38	8.38	0.00	3.42	3.42	3.42
Grand total -	**706**	**548**	**483**	**459**	**621**	**545**	**510**	**486**	**4101**	**2994**	**2691**	**2387**

Estimation of Future Emissions

Baseline future year emissions for each source category are calculated from the base year (1990) emissions using the following equation:

$$EM_{FY} = EM_{BY} \times CF \times GF$$

where:

- EM_{FY} is the forecasted emissions of an air pollutant for any future year,
- EM_{BY} represents the base year emissions of the air pollutant (1990 is the base year in this forecast),
- CF (Control Factor) is an indicator for the level of control imposed as a result of current federal, State and regional air quality regulations, and
- GF (Growth Factor) is an estimate of growth or decline derived from best available data for the different categories. CF and GC are 1.0 for the base year 1990.

Control Factors

The impact of all adopted air pollution control rules are included in emission forecasts by means of control factors. For an individual source category, a future year control factor CF is calculated by the equation

$$CF_{FY} = \frac{E_{BY} - R}{E_{BY}}$$

where

- E_{BY} is the base year 1990 emissions for a category affected by one or more of the air quality rules, and
- R is the sum of emission reductions from the applicable rules.

Thus CF is 1 for 1990 and less than one for years after 1990, if there are reductions from adopted rules The control factors in this inventory take into account all federal State and local air quality regulations in effect prior to March 1, 1994.

Growth Factors

Growth factors are developed for each source category based on population, housing and other parameters developed by the Association of Bay Area Governments (ABAG) and the ARB. The motor vehicles growth rates for the year 2000 are shown in Table H-4 by vehicle type and by county.

TABLE H-4

MOTOR VEHICLE GROWTH FACTORS*

COUNTY	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
Passenger Cars									
Catalytic									
VMT	1.458	1.621	1.354	1.805	1.349	1.435	1.511	1.669	1.606
Trip	1.399	1.533	1.414	1.606	1.322	1.394	1.384	1.857	1.615
Vehicle	1.476	1.684	1.401	1.567	1.151	1.540	1.529	2.028	1.804
Non-catalytic									
VMT	0.119	0.132	0.111	0.150	0.111	0.117	0.123	0.136	0.132
Trip	0.114	0.125	0.116	0.131	0.108	0.114	0.113	0.152	0.132
Vehicle	0.139	0.159	0.132	0.148	0.109	0.145	0.144	0.191	0.170
Diesel									
VMT	0.096	0.107	0.090	0.108	0.090	0.094	0.099	0.109	0.106
Trip	0.091	0.100	0.092	0.105	0.086	0.091	0.090	0.121	0.105
Light and Medium Duty Trucks									
Catalytic									
VMT	1.437	1.593	1.353	1.821	1.367	1.344	1.467	1.678	1.601
Trip	1.379	1.507	1.411	1.618	1.340	1.304	1.344	1.866	1.611
Vehicle	1.514	1.723	1.456	1.639	1.216	1.501	1.546	2.119	1.870
Non-catalytic									
VMT	0.033	0.037	0.031	0.051	0.033	0.032	0.034	0.035	0.036
Trip	0.031	0.034	0.032	0.036	0.031	0.030	0.031	0.042	0.036
Vehicle	0.048	0.054	0.046	0.050	0.038	0.048	0.049	0.066	0.058
Diesel									
VMT	0.100	0.118	0.087	0.083	0.103	0.088	0.108	0.125	0.125
Trip	0.097	0.106	0.100	0.112	0.096	0.093	0.095	0.131	0.112
Heavy Duty Trucks									
Catalytic **									
VMT	18.46	21.50	15.50	21.50	15.33	16.80	18.75	18.22	20.17
Trip	19.61	21.58	20.44	22.07	19.13	19.39	19.49	25.95	22.05
Vehicle	28.08	32.17	27.51	29.18	22.63	29.03	29.20	38.61	33.49
Non-catalytic									
VMT	0.208	0.251	0.167	0.270	0.175	0.184	0.212	0.208	0.230
Trip	0.221	0.243	0.230	0.249	0.216	0.219	0.220	0.293	0.249
Vehicle	0.338	0.387	0.330	0.352	0.272	0.350	0.352	0.463	0.403
Diesel									
VMT	1.373	1.751	1.054	1.809	1.000	1.221	1.433	1.528	1.621
Motorcycles									
Non-catalytic									
VMT	1.000	1.144	0.897	1.154	0.949	0.985	1.044	1.258	1.250
Trip	1.071	1.117	1.112	1.182	1.200	1.005	1.041	1.347	1.255
Vehicle	1.050	1.141	1.024	1.071	0.972	1.032	1.069	1.367	1.304
Urban Buses									
Diesel									
VMT	1.075	1.111	1.000	1.000	1.049	1.000	1.098	1.100	1.100

* Apply growth factor listed in this table to 1987 data to obtain year 2000 data.

** Growth factors for catalytic heavy duty trucks are high because the number of a catalytic heavy duty trucks in 1987 was very small. 1987 was the first year of catalytic convertor use on heavy duty trucks.

Future Baseline Emissions

Total baseline emissions and the relative contributions by sources under District regulation, motor vehicles and other sources are shown in Figure H-1. The total emissions of ROG, NO_x and CO decrease from the years 1987 to 2000 as follows: ROG (35%), NO_x (22%) and CO (42%).

Relative contributions to emissions of ROG, NO_x, and CO by major source categories for the years 1987, 1994, 1997 and 2000 are shown in Figures H-2 to H-5. The figures show that relative contributions of ROG, NO_x, and CO emissions by motor vehicles are declining over the years. Motor vehicles contribute NO_x emissions as follows: 46% in 1987 and 35% in 2000. Motor vehicles contribute ROG emissions: 51% in 1987 and 31% in 2000. Most of the CO emissions are produced by motor vehicles: 79% in 1987 and 60% in 2000.

ROG Emissions

The most significant decrease in ROG emissions between the years 1987 and 2000 is from motor vehicles (1987: 359 tons/day; 2000: 138 tons/day). Lower emissions are attributed to the introduction of newer vehicles that comply with increasingly stringent exhaust and evaporative emission standards, already adopted to cover future years. In 1987, about 20% of the light duty autos in use were not equipped with catalytic converters. By the year 2000, however, essentially all light duty autos on the road will have catalytic converters. The baseline emission factor for the year 2000 includes a non-methane hydrocarbon emission standard, adopted in 1989, of 0.25 grams/mile for light duty autos (LDA) and light duty trucks (LDT). This is significantly more stringent than the current standard of 0.39 grams per mile. A phase-in schedule for new vehicles that comply with the 0.25 grams/mile standard begins in 1993 and will be completed by 1997, when all the new LDAs must meet the standard. Emission reductions are also expected to decline due to the implementation of the improved Inspection and Maintenance ("Smog Check") Program.

NO_x Emissions

NO_x emissions from motor vehicles (1987: 290 tons/day; 2000: 169 tons/day) decrease substantially due to the increased porportion of LDAs equipped with catalytic converters and implementation of an NO_x exhaust emission standard of 0.4 grams/mile; replacing the present standard of 0.7 grams/mile.

CO Emissions

Almost 80% of CO emissions are produced by motor vehicles. Between 1987 and 2000, CO emissions from motor vehicles decrease significantly, leading to a large net decrease in CO emissions in the region. As with NO_x emissions, reductions in CO emissions from motor vehicles reflect more stringent exhaust standards and the use of catalytic converters. In 1993, at least 40% of passenger cars and LDT must comply with a certification exhaust standard of 3.4 grams/mile, half of the current standard of 7.0 grams/mile. By 1997, all passenger cars must comply with the 3.4 grams/mile exhaust standard.

Future Control Effects

All of the emission projections in this appendix represent baseline estimates, incorporating the effects of control programs already adopted at the time of inventory preparation. (Some of the already-adopted programs may have future-effective implementation schedules.) New rules, regulations and programs developed will further reduce emissions to levels below the baseline projections.

FIGURE H-1
Emission Trends

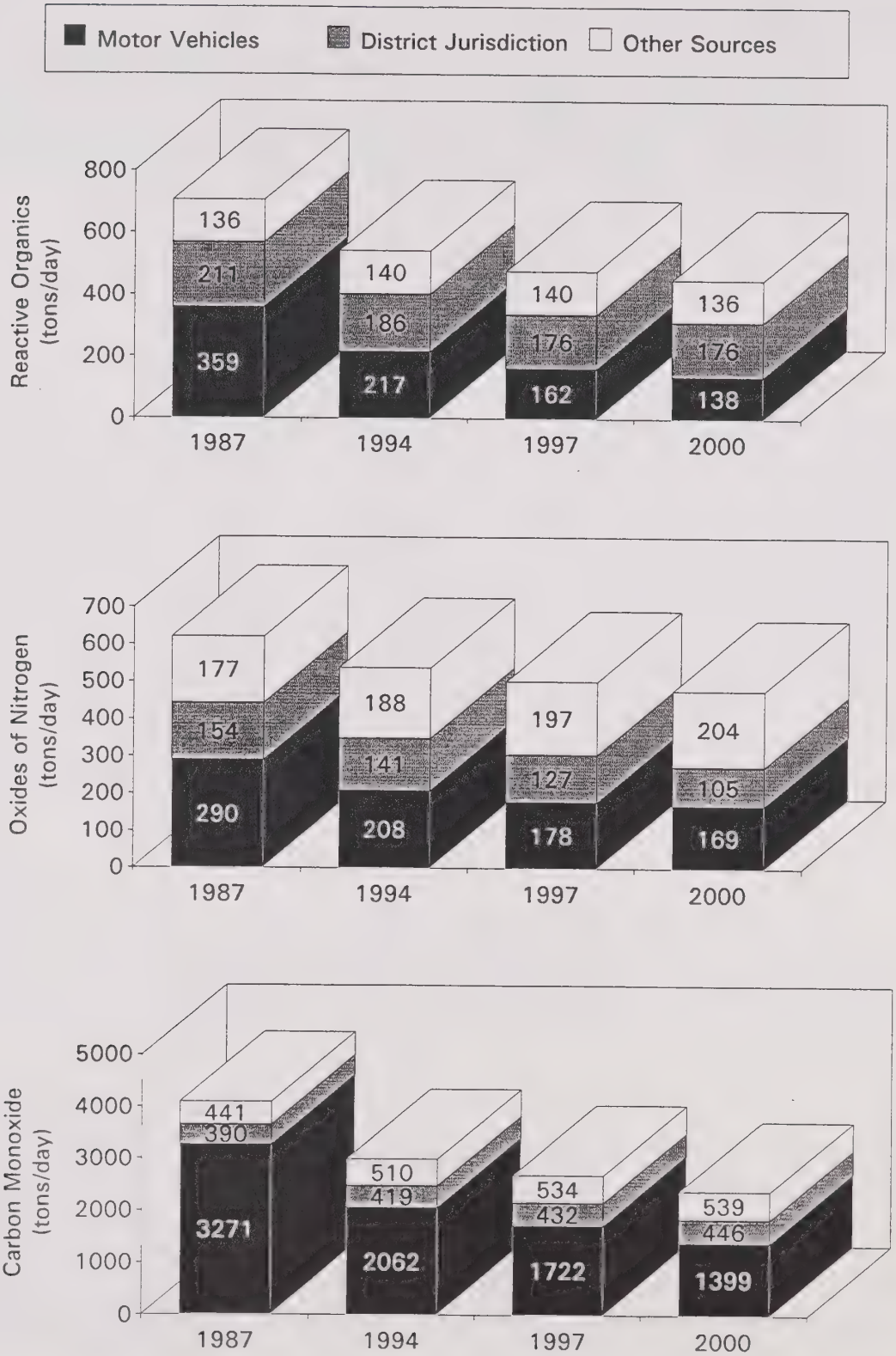

FIGURE H-2

Contribution of 1987 Emissions By Major Source Category

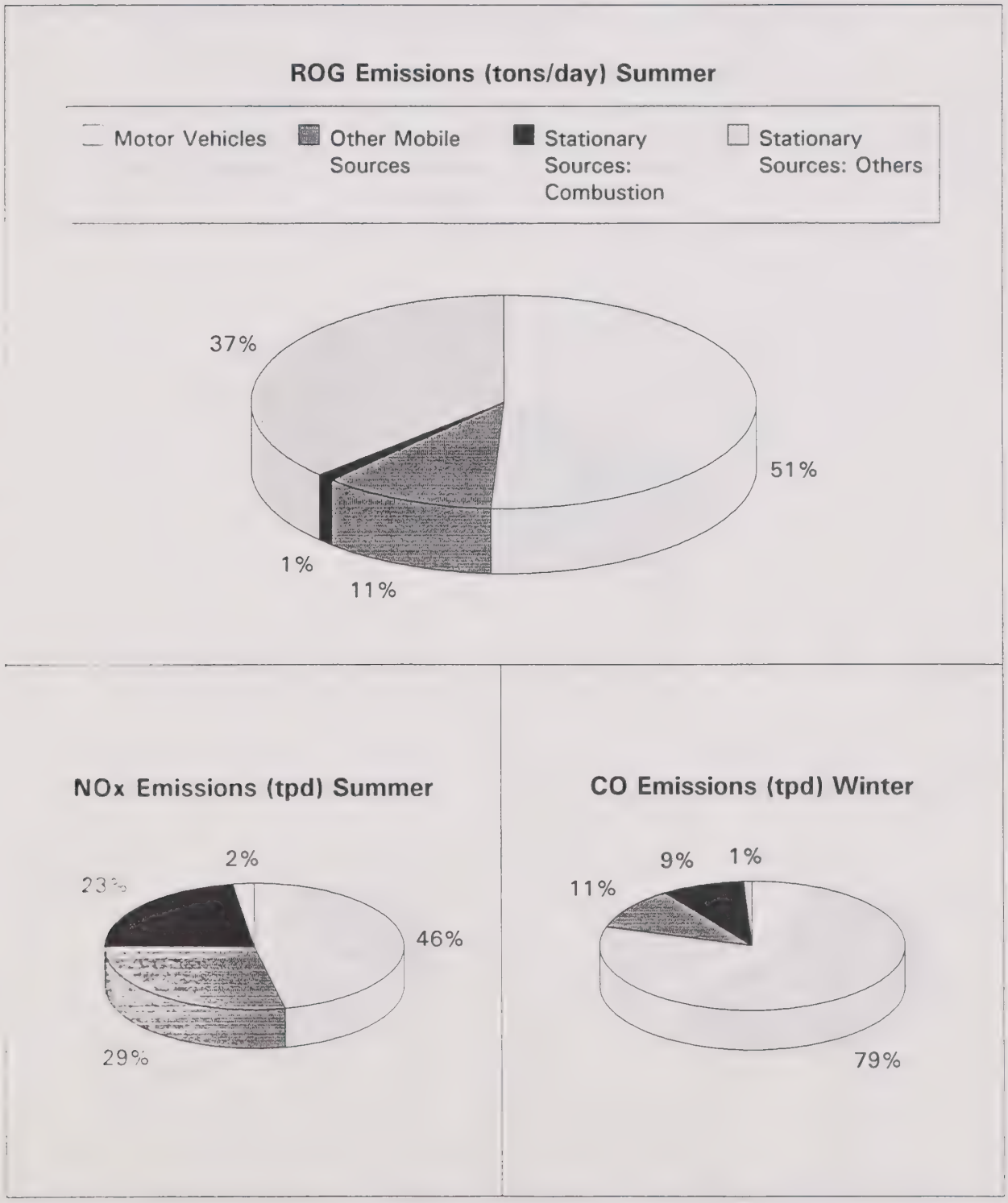

FIGURE H-3

Contribution of 1994 Emissions By Major Source Category

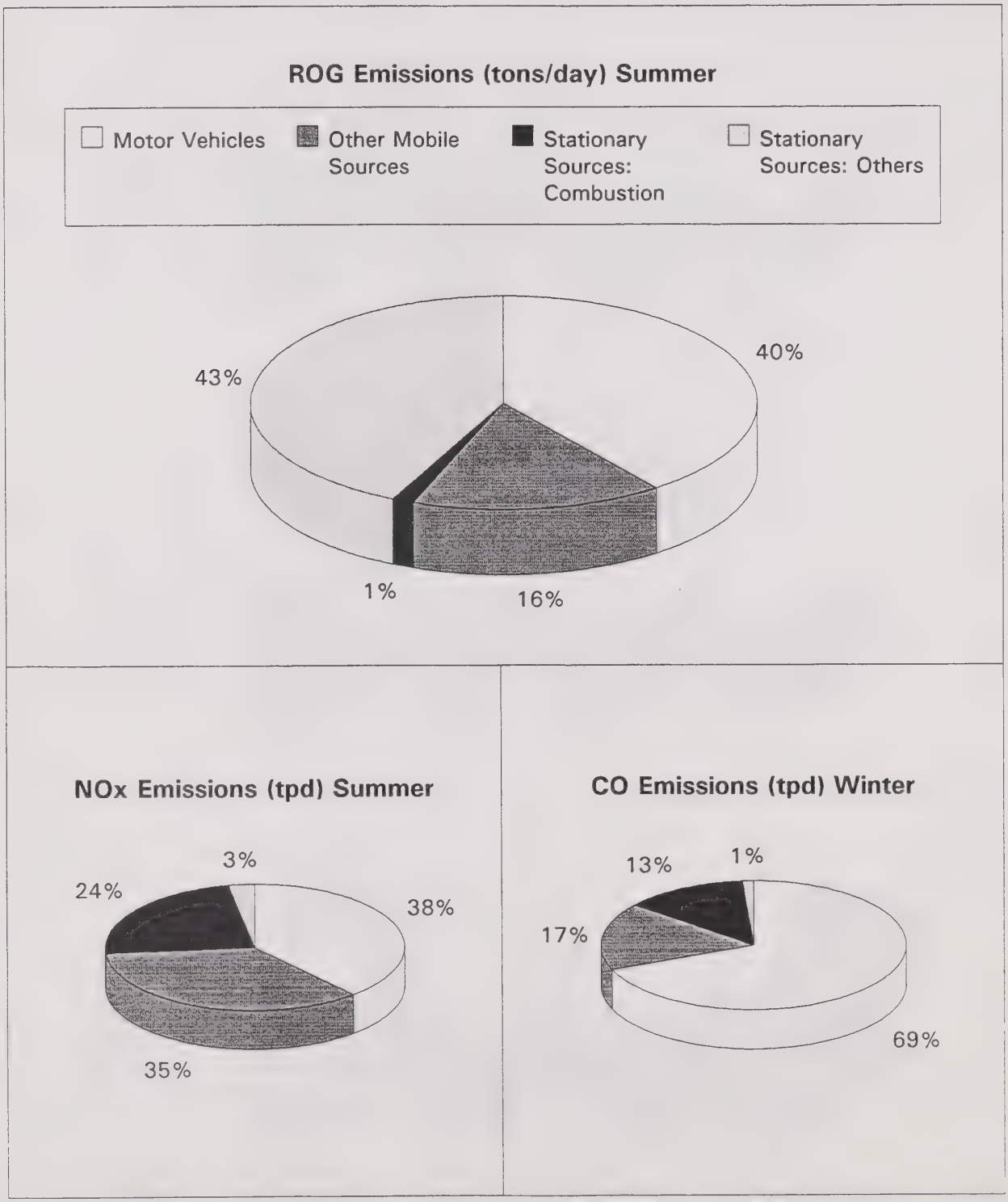

FIGURE H-4

Contribution of 1997 Emissions By Major Source Category

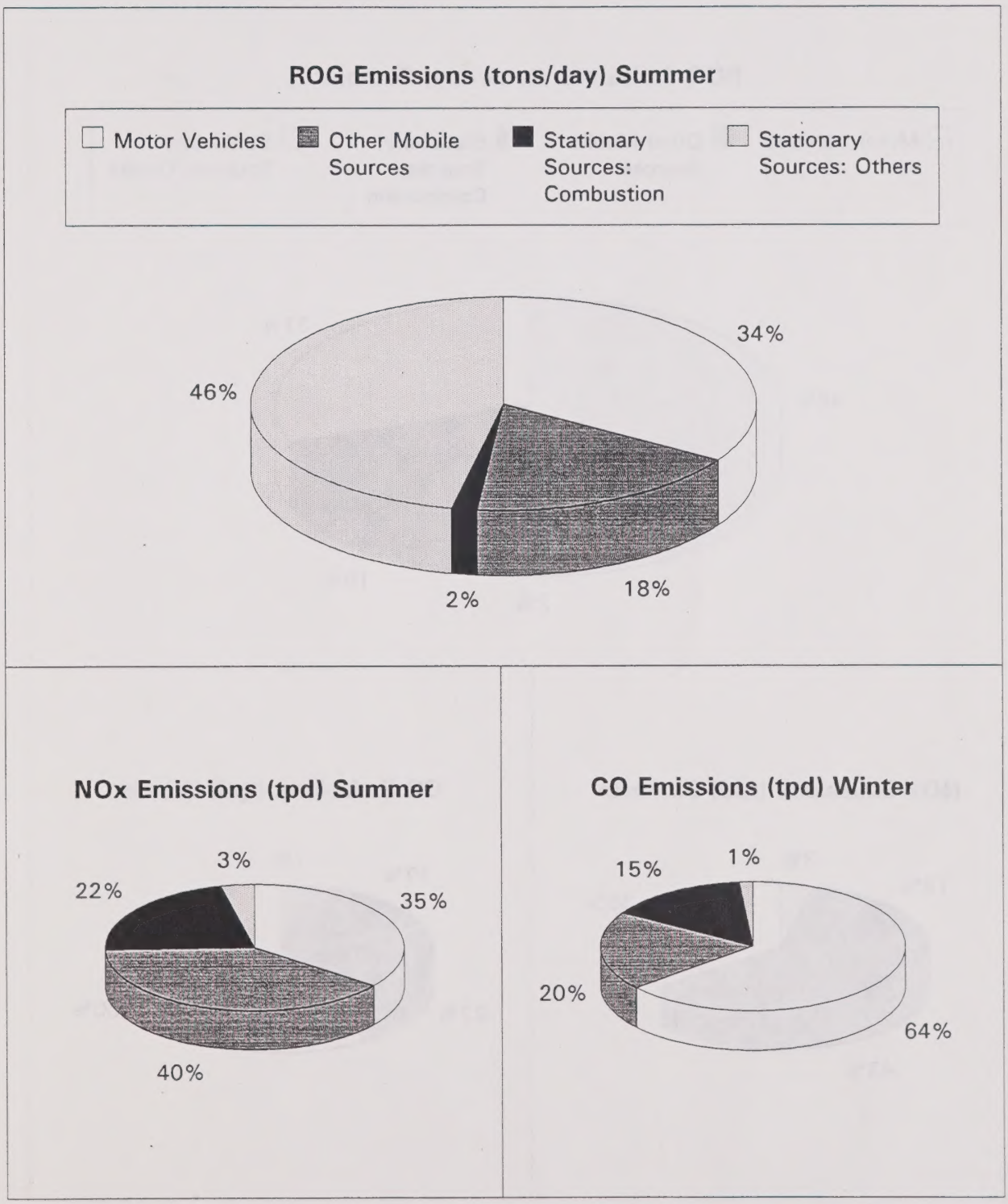

FIGURE H-5
Contribution of 2000 Emissions By Major Source Category